Estimates of Genetic and Phenotypic Parameters of Calf Birth Weight and Calving Difficulty in Limousin Cattle

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Abstract: Genetic parameters for birth weight BW and calving difficulty CD were evaluated in a herd , located in Samalayuca, a representative rangeland system in the desertic region at north of México. Progeny (n=18 and n=19) from 41 dams: heifers and mature cows of a total of 50 dams involving inheritance of Limousin L mated naturally to sires L were used. The objective was to estimate heritability values direct for BW and CD. Separate analyses for each trait used least squares mixed model, SAS (1989). The analytical model included: year of birth, age of dam, sex of the calf, with date of birth as a covariate to adjust a common age as fixed effects; sire and residual as random components. Mean BW was 39.97 kg. BW ranged from 36.00 to 37.94 kg in heifers 29 month-old at parturition. BW ranged from 38.5 to 43.70 kg in mature cows that produced calves at 57 month-old. CD was subjectively evaluated categorically using descriptive scores (i.e., 1=no difficulty, 2= little difficulty by hand, 3 = little difficulty with jack, 4= slight difficulty with a calf jack, 5= moderate difficulty with calf jack, 6= major difficulty with jack and 7= Caesarean birth presentation). Calving difficulty was greater (P<0.05) in heifers (29.8%) than mature cows (11.45%). The sex of the calf was the major source (P<0.05) of variation in levels of CD for both heifers and mature cows. The estimates of heritability values for BW and CD difficulty were (h^2=.29±.07) and (h^2=.05 ±.04), respectively.

Key words: Genetic, Phenotypic, Birth weight, Calving difficulty

Introduction

In beef production, the animal weight represents the most important measurement of productivity, but weight as an expression of productive efficiency must be evaluated in relationship with age. Thus this relationship between kilograms of weight and the required time to obtain them is an expression of growth (De Alba, 1990). Much emphasis has been placed on BW because research has shown it is the single most important factor associated with CD, especially in 2 year old cows where a one pound (454 g) increase in BW results in a 2% in calving CD (Ritchie *et al.*, 1993). Increases in BW are not all bad because genetic correlations between it and components of postcalving growth are positive (Ritchie, 1993). Calving difficulty results in a major economic loss to beef producers (Deutscher, 1991). This loss is estimated to be 750 million dollars annually, nation wide. In such a way CD is becoming a greater concern for beef producers because of the increased emphasis on rapid growth rates, heavier weaning weights and improved cow efficiency. The objective of this study was to estimate heritability values direct for birth weight and calving difficulty.

Materials and Methods

This study used data to characterize the performance of Limousin L cattle in a herd located in Samalayuca, México a representative rangeland system in the desertic region at the north of the country. The data available were on observations on BW, on the progeny of 41 cows of a total of 50 dams involving inheritance of Limousin. All yearling heifers and mature cows were exposed by natural service to sires L of two or more year old to produce calves at 29 and 57 month of age for yearling heifers and mature cows, respectively. The mating season from yearling heifers was from end May to middle of August. CD as trait of dam, was subjectively evaluated categorically. Using descriptive scores (i.e.,1=no difficulty, 2= little difficulty by hand, 3=little difficulty with jack, 4= slight difficulty with a calf jack, 5=moderate difficulty with calf jack, 6= major difficulty with calf jack and 7= caesarean birth presentation).

Management: Cows were maintained in a rangeland of desert brush characterized by Larrea tridentata, Prosopis juliflora, Mimosa biuncifera, Ephedra californica and Atriplex canescence; grasses: Hilaria melangueri, Sporobolus airoides, Aristida trifida and Distichlys spicata. Calving was in (April, May and June). At birth all calves were identified , dehorned (paste) and vaccinated against viral scours. The region where this Limousin herd is located, was affected for a five year drouhgth period. A supplementation program was implemented during the critical periods of those years. Statistical procedures: Separate analyses for each trait used least squares mixed model; SAS (1989). The analytical model included: year of birth, age of dam, sex of the calf, with date of birth as a covariate to adjust a common age as fixed effects; sire and residual as random components.

Results and Discussion

Least squares means for BW and CD are given in Table 1. Calves mean BW was 37.97 kg. BW ranged from 36 kg in heifers 29 month-old at parturition to 41.4 kg in mature cows 57 month-old at parturition. Male calves from cows 29 and 57 month old at parturition were 5.3% heavier than female calves. Due to the actual trend of cattlemen of involving highly muscled Continental breeds as paternal lines, in their commercial beef breeding programs, the practical importance of BW as a selection tool depends on the age at which animals are marketed. Thomas (1992) reported that BW is positively correlated to weaning weight, yearling and mature weights. Therefore selection for any of these traits would cause some increase in BW. A mayor challenge to the beef industry is to find a way to minimize this correlated response in BW. Much emphasis has been placed on BW because research has shown it is the single most important factor associated with calving especially in 2 year old cows where a one pound (454 g) increase in BW results in a 2% in CD (Ritchie *et al.*, 1993).

Table 1: Least squares means for birth weight and calving difficulty of Limousin dams mated to Limousin sires to produce calves to 29 and 57 month age.

Variable	Age to clave		
	29 month	57 month	All ages
Mean birth weight (kg)			39.97
Birth weight (kg)	37.94	41.40	
Birth weight (kg)[a]	36.0 to 37.94	38.5 to 43.70	
Calving difficulty (%)	29.80	11.45	

[a] range of birth weight of calves from heifers and mature cows.

Table 2: Estimates of heritabilities (h^2) and their standard errors of birth weight and calving difficulty of Limousin dams mated to Limousin sires to produce calves at 29 and 57 month age.

Birth weight	Caving difficulty
h^2 =.29±.07	h^2 =.05. ±04

Table 2. shows the estimates of heritability value direct for BW in this study (h^2 =0.29±.07). Strohben *et al.* (1993) reported that a program of selection for low BW could lead to declines in weaning weight and yearling weight, which does not desirable. Nevertheless the author indicates that in 1981 Angus sire evaluation report 673 sires listed, 59 had below average BW but were above average on weaning weight, yearling weight and maternal breeding value.

Most heritability and repeatability estimates of BW of calves have come from beef cattle data. Anderson *et al.*, 1965) used paternal half sib correlation to estimate heritability to be (h^2=0.22) in beef cattle. Koch *et al.* (1955) estimated heritability and repeatability for BW in beef cattle from 4,533 calves. After the data had been adjusted for year and sex effects, they found a heritability value of (h^2=0.35) and a repeatability value of (r= 0.40).

Ferrell (1993) suggests that BW values lower than optimum are associated with reduced energy reserves, lowered thermoregulatory capability and increased calf deaths at or near birth. Low birth weights are also related to low rates of growth after birth and decreased mature size. Conversely, birth weights greater than optimum are associated with greater calving difficulty, calf losses at birth and increased difficulties with rebreeding the cow.

Least squares means in CD are presented in Table 1. As shown CD was greater (P<0.05) in heifers (29.8%) than mature cows (11.45%). The sex of the calf was the major source (P<0.05) of variation in levels of CD difficulty for both heifers and mature cows. These findings agreed to Meijering, 1986; and Phillipson 1976. The authors found that the sex of the calf is a major source of variation in levels of CD and stillbirths; frequencies for male calves being generally about twice as high as for female calves. Laster and Gregory (1973) found not significant differences (P>0.05) in stillbirth prevalence when calving was normal which suggests that more frequent occurrence of stillbirths in bull than in heifers calves is mainly due to a higher incidence of CD. Gregory *et al.* (1992) reported Limousin group means for CD as trait of dam (31.8, 7.2 and 15.7%) for dams of 2, 3 or more and all ages, respectively. The estimated heritability values for CD for Limousin breed reported for those authors were: (h^2=.09±.06 and h^2= .08± .02) for dams of two and all ages, respectively. Table 2. shows the estimated heritability value(h^2=.05 ±.04) for CD in this study. Koots *et al.* (1994), in analyses of published genetic parameter estimates for beef production traits reported averages heritability values unweighted and weighted and their standard errors (h^2=.07±.06 and h^2=.08± .014) for CD based in (n=10 and n=7) studies, respectively.

Conclusion

Estimates of heritabilities are essential population parameters required in animal breeding research and in the design and application of practical breeding. Calves with heavier birth weights have higher than average postnatal

survival if born without excessive problems and have superior subsequent growth. Producers must consider birth weight and calving difficulty as important traits in their breeding programs. Nevertheless, birth weight may be associated with difficult births and high death rates of calves at or near birth. The importance of this relationship varies with breed or cross and is usually more severe in young than in mature cows.

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